Evaluation of Materials Corrosion in Molten Fluoride Salt

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Fluoride-based molten salts are being considered for use in future molten salt reactors (MSR) as well as for heat transport from the nuclear island to the hydrogen production facility, because of their large specific heat and thermal conductivity, high density at low pressures, resistance to radiolysis, and relative chemical inertness. However, materials corrosion is an issue in high temperature molten fluoride salts, because unlike other high temperature environments, the protective passive oxide film is generally unstable in molten fluoride salt environments. Corrosion testing of materials in this environment presents unique challenges because of the reactivity of molten salt as well as the sensitivity of materials corrosion to salt purity. A research program is underway at the University of Wisconsin for corrosion testing of candidate materials in molten FLiNaK (46.5LiF-11.5NaF-42KF mol%) salts of varying purity at a temperature of 1000^{o}C for an exposure duration of 500 hours. Specially designed high-density graphite crucibles and sample fixturing systems encapsulated in thick walled stainless steel containments have been built for these corrosion experiments. Alloys for first phase evaluation include Hastelloy-X, Hastelloy-N, Haynes-230, Ni-201, Incoloy-800H, Nb-1Zr, and nickel-plated Incoloy-800H. Development of the corrosion test cell and results of corrosion tests on the different alloys and the effect of salt purity on corrosion will be presented.

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